THE AËRONAUTICAL JOURNAL.

JULY, 1907.

The Aëronautical Journal.

(PUBLISHED QUARTERLY.)

SUBSCRIPTION PER ANNUM (post free), 4s.

Communications respecting Advertisements to be addressed to the Publishers, "Aëronautical Journal,"

Messrs. KING, SELL & OLDING, Ltd.,
27, Chancery Lane, W.C.

Editorial communications should be addressed to the Editor,

53, Victoria Street,
Westminster, London, S.W.

NOTICES OF The Aëronautical Society of Great Britain.

At a meeting of the Council of the Aëronautical Society of Great Britain, held at 53, Victoria Street, Westminster, S.W., on April 26, 1907, the following gentlemen were elected Members of the Society:—

MR. JAMES ROBERTSON PORTER, A.M.I.C.E.
LIEUT. NEVILLE F. USBORNE, R.N.

At a meeting of the Council of the Aëronautical Society of Great Britain, held at 53, Victoria Street, Westminster, S.W., on June 24, 1907, the following gentlemen were elected Members of the Society:—

MR. THOMAS WIGSTON KINGLAKE CLARKE, B.A., A.M.I.C.E.
MR. BERT G. COURTRIGHT.
MR. ALFRED DENYS COWPER.
MR. MAURICE F. FITZGERALD.
MR. LOUIS FERGUSON GOWANS.
MR. LAWRENCE LESH.
MR. ALEARDO MANZATO.

THE LIBRARY.

The following publications have been presented to the Library:—

By R. Oldenbourg, "Die Luftschiffahrt." (A. Hildebrandt.)

By W. R. Turnbull, "Researches on the Forms and Stability of Aëroplanes." (W. R. Turnbull.)

By the Meteorological Office, "Publications of the International Commission for Scientific Aëronautics, January, 1905."

By Colonel F. C. Trollope, Various Publications of the International Commission for Scientific Aëronautics.

By Messrs. Blackwood, "Ballooning as a Sport." (Major B. Baden-Powell.)

On receipt of the sad news of the Aldershot balloon disaster the Aëronautical Society of Great Britain, through its Hon. Secretary, communicated its sympathy to Colonel J. E. Capper, Superintendent of the Government Balloon Factory and Member of Council of the Aëronautical Society of Great Britain.

THE INVESTIGATION OF THE UPPER ATMOSPHERE.

The International Commission of Scientific Aërostation at its meeting at Milan in 1906, resolved to carry on during the years 1907 and 1908 the investigation of the upper atmosphere in the Northern Hemisphere on a much more extended scale than has been hitherto attempted. On account of the great importance of such researches for the progress of meteorology, the Royal

Meteorological Society has been invited to take part in this scheme.

The Council of that Society are desirous of securing the co-operation of observers in different parts of the British Empire north of the Equator, and they propose, if possible, to organise and equip special stations for this purpose.

In connection with the investigation, ballons-sonde to carry self-recording instruments, and also smaller balloons are to be used, the heights and drift of which will be determined by two theodolites placed at the ends of a fixed base. The ascents in 1907 are to be made on three consecutive days in each of the months of July, September and November, one balloon to be sent up on each of these days.

The Aëronautical Society of Great Britain has been asked by the Royal Meteorological Society whether some more members of the former Society will be willing to take part in this work. Most of those who are at present engaged in the investigation of the upper air in this country are members of the Aëronautical Society. Amongst these being Mr. W. H. Dines, F.R.S., Mr. Charles Cave, and Mr. S. H. R. Salmon, and it may be pointed out that the first observer who sent up a ballon-sonde in this country was Mr. Patrick Alexander, a member of the Aëronautical Society.

It is to be hoped, therefore, that other members will be willing to join with the Royal Meteorolgical Society in their investigations. It may be pointed out that such researches besides being of Meteorological value have an important bearing on the navigation of the air, for knowledge of the laws which govern the movements of the atmosphere is one of the first steps towards its conquest.

ERIC STUART BRUCE,
Honorary Secretary

GENERAL MEETING.

The concluding meeting of the 42nd session of the Aeronautical Society of Great Britain was held on Chobham Common on July 1st, by kind permission of Lord Onslow and the Sunningdale Golf Glub.

There was a large assembly of the members and their friends. It was estimated that from first to last there were upwards of three thousand visitors present.

On this occasion there was a display of scientific kites in the air and other aëronautical experiments.

Those who displayed kites in the air were Mr. W. H. Dines, F.R.S., M. Aër. Soc., Mr. Charles J. P. Cave, M. Aër. Soc., Mr. S. H. R. Salmon, M. Aër. Soc., Mr. R. M. Balston, M. Aër Soc., and Mr. Charles Brogden.

A meteorograph and two kites of the kind in common use at the station of the Meteorological Office at Pyrton Hill were exhibited by Mr. W. H. Dines.

Meteorograph.

Recording height, temperature, humidity, and wind velocity.

Kite No. 22.

Nine-foot kite. Seventy-seven sq. ft. of lifting surface. Weight, 11 lbs. The kite had been in use at Pyrton Hill, Watlington, Oxon, since March, 1907, and had made about 20 ascents. It is used for light and moderate winds, and with a good wind and about 10,000 ft. of wire will lift the meteorograph to a vertical height of 6000 ft. When over 3000 ft. high these kites will fly quite steadily with winds of less than 40 miles per hour; there are a few records showing 50 miles per hour, but in general they either become unstable or the strain breaks the wire if the velocity exceeds 45 miles per hour. The angular altitude at which they fly is shown below, the figures being the averages for the year 1905.

Length of wire—	Ft.	Ft.	Ft.	Ft.	Ft.	Ft.
	2000	3000	4000	5000	6000	7000
Angle—	60°	57°	52°	49°	47°	45°

Kite No. 23.

Seven-foot six-inch kite. Fifty-two sq. ft. Weight, 9 lbs. This kite has made 18 ascents. With 5000 ft. of wire it carries the instruments to a height ranging from 3000 ft. to 3500 ft. It will fly in winds ranging from 25 to 50 miles per hour.

Note.—The upper winds are much stronger and also much steadier than those at the surface. Inland, at 1500 ft. high, the velocity is often double what it is at the surface, and it is the upper winds which are referred to above.

Mr. Charles Cave also exhibited a box kite of the type used by Mr. Dines.

Mr. Salmon's exhibit was remarkable for originality and the number of the forms of kites exhibited. One of these kites was made specially for this display, and has nine wings at each side of a backbone, 18 ft. high. The wings have a span from tip to tip of 10 ft. Mr.

The Kite Display of the Aeronautical Society of Great Britain on Chobham Common, July 1st, 1907.
General View showing eleven Scientific Kites in the air at one time.

Ascent of Ballon Sonde with Self Recording Instrument at Kite Display, July 1st, 1907.

Mr. José Weiss' Model Glider in Flight at the Kite Display, July 1st, 1907.

Another View of Mr. José Weiss' Model Glider in Flight at the Kite Display.

Salmon claims that this type of kite is an excellent one for light winds, and is very easy to manipulate. A kite of the same pattern has often enabled him to raise his meteorograph 500 metres when a box kite would not have left the ground.

Mr. Salmon's claims for this form of kite were well borne out by actual test in the display when a light wind was blowing. The kite attained a considerable height—some 3000 ft.—and was remarkably steady. Colonel A. P. Loyd, one of the spectators of the display, suggested that such a form of multiple wing kite might possibly be found to be advantageous for a war kite on account of its comparative invisibility.

Amongst the other kites displayed in Mr. Salmon's undoubtedly fine exhibit were several types of box kites and a Hargrave kite made by Mr. Hargrave. Some of his box kites had the acute angle to the front and some the obtuse.

Another kite shown by the same exhibitor was a quinquangular box kite and the Barclay honeycombed kite, an illustration of which will appear in our next issue.

Mr. Charles Brogden, who in the Society's Kite Competition at Findon in 1903 attained the highest flight with his six-winged bird kite, again gave a demonstration of the admirable flying qualities of this kite, a full description of which will be found in the January number of this Journal, 1904.

Mr. Brogden estimated the height attained on the latter occasion at about 3000 ft. (perpendicular), 3800 ft. of wire being out. The angle of the kite was fairly constant at 56 to 60 degrees from the horizontal.

Mr. Balston exhibited Zenith kites and Butterfly kites. The former are adapted for flights in strong winds, and the latter for use in only light winds. These kites were much admired on account of their graceful form, and they flew well. His Butterfly kite rising is shown in the accompanying illustration from a photograph taken on the spot by the Society's special photographer.

At the commencement of the display, the spectacle of eleven large scientific kites in the air at the same time was a unique one. The general view of the display obtained by the Society's photographer and here reproduced will give some idea of the novel sight.

A ballon-sonde carrying instruments was sent up by Mr. Charles Cave. A small rubber balloon was used having a capacity of between six and seven cubic feet when unstretched, but it would expand to a considerably larger size. The balloon was filled with hydrogen and had a linen parachute placed over it and a meteorograph hung below. A balloon of this kind continually expands as it rises, finally bursting, when the instruments are brought gently to the ground by means of the parachute. The instrument used on this occasion was the light meteorograph designed by Mr. W. H. Dines for balloon work; it records pressure and temperature by means of two fine points which scratch lines on a small copper plate; this plate is moved laterally by the expansion of an aneroid box; the thermometer consists of a steel rod and a thin strip of aluminium, their difference of length, multiplied by a lever, regulates the distance between the two points. The temperature is therefore measured by the distance between the two scratches, and this is read off under a low power of the microscope; the temperature may be read to about half a degree Fahrenheit.* The instrument is enclosed in an aluminium cylinder to protect it from the direct rays of the sun and to prevent it from getting damaged when it comes to the earth. The total weight of the instrument with the cylinder is only about 2 ozs. A label offering a reward for the recovery of the instrument completes the equipment of the balloon. The ascent of the balloon was observed with theodolites placed at each end of a base of about 1560 feet set out at right angles to the direction of the wind. One theodolite was an ordinary transit instrument; the other has been specially designed by M. de Quervain for observing balloons; it has a reflecting prism in the axis of the telescope so that the observer is always looking in a horizontal position even if the balloon is passing through the zenith. The vertical and horizontal circles are graduated to degrees only, thus enabling readings to be taken very quickly, a matter of some importance when observing a balloon that is moving rapidly across the field of the telescope.

The balloon sent up at Chobham Common was found to ascend at a rate of about 450 feet per minute; from observations of the motion of the balloon it appeared that the wind was north east half north near the

*A full description of this instrument is to be found in Symons's Meteorological Magazine for July, 1906.

ground but that it backed to about north at 3000 feet; at the same time the velocity which was twelve to fifteen miles per hour near the ground gradually fell off till it was little more than six miles an hour at 3000 feet. The sky was covered with cumulus clouds which were reached by the balloon in about seven-and-a-half minutes at 3300 feet.

Some years ago M. Teisserenc de Bort began to take observations of *ballons-sonde* from two stations at some distance apart, and was thus able to plot out the course of the balloon as long as it remained visible. By using balloons whose rate of ascent has been previously determined it is possible to trace the course of the balloon, and thus to find the wind velocity and direction at different heights, by means of observations taken with a single theodolite; this method has been employed by Professor Hergesell, M. de Quervain and others. Mr. Cave sent up a small pilot balloon about an hour after the ballon-sonde and was able to follow it till it was lost in some alto-cumulus clouds at over 6000 feet. The balloon was a small rubber balloon of a little over four cubic feet capacity, and when filled with hydrogen to lift 85 grammes in addition to its own weight it ascends at the rate of about 500 feet per minute.

The filling and the ascent of the ballon sonde excited the greatest interest, evidenced by the subsequent anxiety displayed in Sunningdale as to the safety of the despatched recording instruments, an anxiety relieved on July 4 when the following telegram from Mr. Cave was received by the Honorary Secretary of the Society. "Monday's balloon fell Upminster, Essex, forty-one miles east by north half north."

Mr. José Weiss may certainly be congratulated on the success of his experiments with model gliders. His demonstration of the possibility of the maintenance of balance for a considerable distance with a model launched from a hill top was one that should encourage himself and others in further research into the difficult problems of the aëroplane.

He exhibited three model gliders having wing areas of 3·6, 8·4, and 12·8 square feet with total weights of 2½ lbs., 6 lbs., and 15 lbs. respectively, the lead ballast in each case representing about two thirds of the total weight.

When launched from the highest hillock available the best glides obtained were some 200 yards in length with drop of from 30 to 50 feet.

The small model raised some 200 feet by Mr. Brogden's large kite and released from that height, righted itself instantly in each case and gave some very fine glides, the longest being probably about 600 yards.

The 15 lbs. model under a similar test also gave a fair glide.

The accompanying illustrations show Mr. Weiss' model glider in flight. The site selected for the kite display proved to be admirable for the purpose, and it has been pointed out by the *Morning Post* that the nature of the ground with its unequal heather-grown surface constituting a retarding influence on the wind was also very advantageous in the starting of the large kites.

The Society is much indebted to Mr. C. S. Rolls for his kindness in placing one of his motor cars at its disposal for the conveyance of visitors.

Amongst those present were Captain Ostertag, the German Military Attaché; Colonel R. E. Capper, C.B., R.E., Superintendent of the Government Balloon Factory; Colonel F. C. Trollope, Mr. E. P. Frost, Mr. W. H. Dines, F.R.S., Major B. Baden-Powell, Colonel J. D. Fullerton, R.E., Mr. Eric Stuart Bruce, Hon. C. S. Rolls, the Hon. S. and Mrs. Erskine, Mr. S. F. Cody, Mr. W. F. Reid, Mr. R. Inwards, Major R. F. Moore, Mr. Shaw Kennedy, Sir David and Lady Barclay, Mrs. Cave, and Mrs. Charles Cave, Mrs. Edwards, Mr. De Salis, Captain and Mrs. Montagu, Colonel A. P. Loyd, Mr. H. Blackett, Colonel and Mrs. Walker, and Miss Merewether.

Letters and telegrams of regret were received from the following, who had intended being present, but who were prevented at the last moment from attending owing to their official duties. The Norwegian Minister, Dr. Fridtjof Nansen, the Austrian Military Attaché, Dr. W. N. Shaw, F.R.S., Director of the Meteorological Office, Professor C. V. Boys, F.R.S., and also from Dr. H. R. Mill, President of the Royal Meteorological Society.

M. Santos Dumont's No. 16.

By a Member of the Aero Club of France.

Students of the aëroplane may have been disappointed to hear that M. Santos

The Kite Display. Mr. Balston's Kite.

Some of the Council of the Aeronautical Society of Great Britain and their Friends at the Kite Display, July 1st, 1907.

Col. Capper. The German Military Attaché. Col. Trollope.

Mr. Dine Hon. C. S. Rolls. Mrs. Bruce. Major Baden Powell. Mr. Frost. Col. Fullerton. Mr. Bruce.

Dumont had at any rate temporarily abandoned the strictly aëroplane principle for a new form of steerable balloon combining both aëroplane and balloon. The heavier-than-air principle is, however, maintained in this cross-breed construction, and it cannot rise in the air until sufficient forward movement on the ground has been attained.

The apparatus consists of the now well-known cigar-shaped envelope, 21 metres long, having a master diameter of 3 metres, and a capacity of 99 metres. Inside the outer envelope is the ballonet, made of gold-beater skin, and 2·60 metres in diameter. This secures the rigidity of the outer envelope.

The inflated envelope is attached to a bamboo frame, strengthened towards the middle by iron tubing. Here is placed the 50 horse-power Antoinette motor—the identical one which drove the "Bird of Prey" from the ground and through the air for 220 metres last November. Behind the motor is a small bicycle saddle for the aëronaut and the controlling wheels. The bicycle wheel on which the frame is mounted is furnished with a pneumatic tyre. Beneath the balloon both back and front two horizontal rudders or planes are fixed, and there is a vertical rudder for lateral movements at the rear. It is found that the entire apparatus, including the aëronaut, weighs about 80 kilogrammes, and it is this dead weight which has to be overcome by the forward movement through the air acting upon the horizontal planes. It is considered that the apparatus solves the difficulties of side balance, and will facilitate keeping the entire machine horizontal in the air.

The first trial on June 8 was not very conclusive. M. Santos Dumont first drove the machine along the ground at the low speed of 10 to 12 kilometres. After the machine had traversed 30 metres M. Santos Dumont, thinking that the machine was well balanced and that all the assistants who were holding it at the back had let go, increased the speed. The assistants, however, had not released their hold. They did so, however, at the moment the speed was increased, and the machine immediately plunged downwards against the ground, the envelope of the balloon was burst, and the framework injured.

M. A. Cléry, in *L'Aérophile*, attributes the accident to the defective position of the screw, which facilitated downward plunges of the machine, while the column of air driven by the propeller towards the fixed surface of the back aëroplane, by sending up the back of the machine, tends to depress the whole.

Distribution of Weight in Aeroplanes.

By Maurice F. Fitzgerald, B.A.

This note deals with the question of the most suitable proportions of the whole weight to be allotted to the engine, wings, and other load, respectively, in aëroplanes driven by propellers. The results must, of course, be regarded as merely approximate, and suited for roughing out the preliminaries of the design, at best; the principal point brought out being the circumstance that there is, in given cases, a best proportion between these items, which will permit of the largest possible load being carried by a machine of given total weight. It is assumed, for simplicity, that the machine is flying horizontally in still air; that the pressure of the air on the wings is at right angles to their surface, taken to be plane; that this pressure is proportional to their area, to the square of the speed, and to the line of the angle of their inclination to the horizontal, jointly; and that direct head resistance due to framework, &c., may be ignored, or allowed for in estimating the efficiency of the propeller.

The data generally taken to be given would be the weight per square foot of the wings, the weight per B.H.P. of the engine, the speed, and the load to be carried. For convenience in calculation it will be found simpler to take, instead of weight of engine per B.H.P., the foot pounds of work per second per pound weight of engine; and to investigate, in the first instance, the value of the ratio of weight of wings to total weight, including the load, engine, and wings all together, when the load is a maximum.

The following symbols are employed.

V = velocity in feet per second.

A = area of wing surface in square feet.

β = angle and inclination of wing plane to horizontal.

w = weight of wings per square foot in pounds.

E = weight of engine in pounds.

e = foot pounds per second per pound weight of engine so that Ee = total foot pounds per second.

Ee is taken to mean the effective foot pounds available as thrusting power; about double this would be necessary as B.H.P.

L = load carried, other than wings and engine, in pounds.

P = air pressure on wings, in pounds.

K = a constant determined by experiment, defined by Eqn. (I.), below.

W = total weight = Aw + E + L, being wings, plus engine, plus other load.

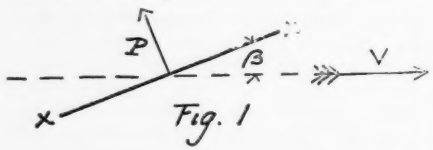

Fig. 1

In Fig. I. $\times\times$ represents an edgewise view of the wing plane, flying horizontally in the direction of the arrow V, the plane being inclined at angle β to the horizontal, and subject to air pressure P in consequence. In accordance with the assumptions made above

$$P = KV^2A \sin \beta \qquad \text{Eqn. (I.).}$$

The vertical component of P is P cos β, and if β be a fairly small angle, such as 5 to 10 degrees, cos β is unity within one or two per cent., and sin β is practically equal to β taken in circular measure, so that, as the value of K is uncertain within much wider limits than this, it is amply sufficiently accurate to take P as the direct supporting force vertically and put

$$P = W = KV^2A\beta \qquad \text{Eqn. (II.).}$$

The horizontal component of P is P sin β, $= KV^2A \sin^2\beta$, and, being opposed to the forward motion of the plane, has to be balanced by the propeller thrust, hence

$$\text{Thrust} = KV^2A\beta^2$$

and work done by thrust = thrust $\times$ velocity gives work done in foot pounds per second $= KV^3A\beta^2 = Ee$ Eqn. (III.).

Now

$$KV^3A\beta^2 = \frac{\{KV^2A\beta\}^2}{KVA}$$ identically on squaring the numerator and dividing by the denominator; that is, as $KV^2A\beta = 2W$, by Eqn. (II.).

$$Ee = KV^3A\beta^2 = \frac{W}{KVA}, \text{ so that } E = \frac{W^2}{KVAe}$$

Eqn. (IV.).

Also

$$W = Aw + E + L.$$

Substitute in this the value of E by Eqn. (IV.) and solve for L, the external load.

$$L = W - Aw - \frac{W^2}{KVAe} \qquad \text{Eqn. (V.).}$$

Now seek the condition that L, the load, shall be a maximum, given that the total weight is fixed, as well as the speed, and the energy of the engine per lb. of its own weight, the wing area being varied, and its weight per square foot known. That is, differentiate with respect to A and put

$$\frac{dL}{dA} = 0.$$

This gives

$$\frac{dL}{dA} = 0 = -w + \frac{W^2}{KVA^2e}, \text{ from which}$$

$$Aw = \frac{W^2}{KVAe} = E \text{ by Eqn. (IV.).}$$

Eqn. (VI.).

That is to say, the weight of the wings should be equal to the weight of the engine, in order that the remainder of the total weight may be a maximum; and in that case, multiplying Eqn. (VI.) across by Aw, we find

$$A^2w^2 = \frac{W^2w}{KVe} \text{ or } Aw = W\sqrt{\frac{w}{KVe}}.$$

Eqn. (VII.),

thus determining the weight of the wings, and therefore that of the engine, which is the same. The load is then the remainder of W, that is

$$L = W - 2W\sqrt{\frac{w}{KVe}} = W\left(1 - 2\sqrt{\frac{w}{KVe}}\right),$$

Eqn. (VIII.),

from which

$$W = \frac{L}{1 - 2\sqrt{\frac{w}{KVe}}}, \text{ thus finding the}$$

total weight required to carry a given load. For example, if the load be 200 lbs., with wings weighing $\frac{1}{3}$ lb. per square foot, and engine giving 20 foot pounds per second per lb. of its own weight as available thrusting power, speed 40 miles per hour (say, 60 feet per second nearly enough), we have L = 200; w = $\frac{1}{3}$; V = 60; e = 20; and we may take K = 0·0017 for velocities in feet per second.

This makes, in Eqn. (VIII.),

$$W = \frac{200}{1 - 2\sqrt{\frac{1}{3} \times \frac{1}{0{\cdot}0017 \times 60 \times 20}}}$$

$$= \frac{200}{0{\cdot}19} = 1052 \text{ lbs. total weight. Deduct-}$$

ing the 200 lbs. of load, leaves 852 lbs. to be divided equally between engine and wings, which thus weigh 426 lbs. each. The wings have three square feet per pound weight, and their area is thus 1280 square feet, nearly; the engine gives 8520 foot pounds per second work, which, as 550 foot pounds per second is one horse power, is 15½ horse power by propeller. About double this would have to be the B.H.P. of the engine itself—say, 35 B.H.P. The weight of the engine being 426 lbs, is thus 12 lbs. per B.H.P. nearly.

The most uncertain elements in the calculation are the value of K, and the efficiency of the propeller, as to which extent experiments give very discordant results.

In the case of models, there is practically no external load, that is, $L = O$ in the equations above used. In that case Eqn. (V.) becomes $W - Aw - \frac{W^2}{KAVe} = O$, which, on multiplying across by Aw and rearranging, becomes a quadratic for Aw,

$$A^2w^2 - WAw + \frac{W^2w}{KVe} = O \qquad \text{Eqn. (IX.)}$$

having two roots, usually unequal, for Aw, whose sum is W, the total weight, so that if one be chosen as weight of wings, the other is weight of engine.

It will be found, on trial, that if the smaller root be chosen for the wings, the inclination, β, required is too large for the formula for the pressure, Eqn. (II.), to be trusted as accurate enough, since it does not correctly represent the value of the weight supported for values of β exceeding 10° at most, or thereabouts.

Taking the larger root in Eqn. (IX.)

$$Aw = \frac{W}{2}\left\{1 + \sqrt{1 - \frac{4w}{KVe}}\right\} \qquad \text{Eqn. (X.).}$$

This is $= \frac{W}{2}$ exactly only in the case when $4w = KVe$; that is $\frac{w}{e} = \frac{KV}{4}$, and if $\frac{w}{e}$ be greater than this, the quantity under the square root becomes negative, which translated into physical facts, means that the machine cannot fly at all.

In other words if $V = 30$ (say 20 miles per hour) $K = 0{\cdot}0017$ as before, $\frac{w}{e}$ must be less than 0·013.

In small models, w may be easily made as small as $\frac{1}{16}$ to $\frac{1}{10}$ lb. (say 1 oz. to 1½ oz.) per square foot, and values of e from 5 to 8 foot pounds per second per lb. of engine suffice for flying.

Taking the extreme case of wings being so light, no matter what their area, as to be of weight negligble compared to that of the engine, or engine and load combined, $A = \frac{1}{KVe} \cdot \frac{W^2}{W - L}$ if there be a load, or $= \frac{W}{KVe}$ in the case of the model; there is no special maximum or minimum condition connected with the ratio of engine weight to load in this case.

The only useful purpose which might be served by Eqn. (X.) would be, perhaps, to determine the value of K, if the energy of the engine at different speeds of flight were accurately known; but there seem to be considerable difficulty in effecting this measurement with exactness, and Eqn. (IV.) will equally well answer the purpose of determining K, if the power be known. This formula (Eqn. IV.) is that from which Langley deduced his well known conclusion that, with a given size and weight of plane, the horsepower required varies inversely as the speed.

The principal points brought out therefore in this note are:—

(*a*) That in aëroplanes carrying an external load we may expect that the best distribution of weight between wings, engine, and load will be, approximately, that the weight of engine will be about equal to the weight of the wings, but that considerable uncertainty, pending further experiment, attaches to the proportion of load to total weight, and that it depends in any case on the speed and on the energy of engine.

(*b*) That this rule does not hold in the case of models flying unloaded, in which the weight of the wings would probably exceed that of the engine, but not necessarily, so that no certain rule can be expected to be derived from experiments on unloaded models, regarding the proper ratio of engine and wing weights.

The Jamestown Aëronautical Congress.

The following particulars of the Jamestown International Aëronautical Congress have been received:—

The Congress will be held in the Hall of Congresses of the Jamestown Exposition, at Norfolk, Virginia, commencing at

10 a.m., October 28, 1907, and continuing two days.

Papers and exhibits are solicited from specialists and amateurs throughout the world. All papers, and especially those requiring translation, should be received by the Secretary not later than September 15.

The following subjects are suggested as suitable for addresses, papers, and discussions:—

1. Opening address: General *résumé* of the history and present status of aërial locomotion.

2. Informal addresses by representatives from other nations, reviewing the recent development of the science, the present projects, investigations, aëronautic establishments and enterprises in their respective countries.

3. Description of laboratories, instruments, and methods of experimentation for determining laws and data useful in the science of aëronautics.

4. Laws of flow, pressure, and friction of air as determined by recent experiments; formulæ for computing the support and resistance of hulls, and framing of balloons and flying machines.

5. Theory and design of aërial propellers, screws, wings, or other forms, giving efficiencies, actual and computed, and the practical advantages of the different types.

6. Aëronautic motors; steam, internal combustion, electric, turbine, &c.; their effectiveness, reliability, weight per horse power, &c.

7. Materials for aëronautic construction, whether for balloons or flyers, including the strength and weight of fabrics, metals, woods, &c.

8. Principles of aëronautic structural design; forms of greatest strength and lightness with least atmospheric resistance.

9. Behaviour of air currents observed at various altitudes; the prevalence, trend, and force of winds, &c.

10. General comparison of the various types of aërial craft, their functions and usefulness, whether for traffic, pleasure, or war; their possible speed, range, cargo, reliability, &c.

11. Full technical accounts of the construction and operation of recent successful and partially successful dynamic flying machines, with an estimate of their possibilities and future development.

12. Special features of flying and gliding machines, illustrated by theory and experiment, including stability, manipulation, propulsion, safety, launching, landing, &c.

13. Soaring and gliding machines; practicability of travelling over land and sea without motive power, as practised by vultures and gulls; efficiency of human gliders compared with sailing birds; proposals for developing the science and art of soaring.

14. Design and manufacture of balloons, illustrated description of balloon factories and their products, details of construction, inflation, management, cost, recent improvements, &c.

15. Manœuvring of balloons in diverse circumstances of weather and locality, particularly in racing, long distance flight, and flight toward a specified goal.

16. Observations, records, and signals in balloons, meteorological, photographic, military; description of instruments used.

17. Full technical accounts of the motor balloons; their design and construction, their best achievements, their possibilities, their probable use in exploration, war, &c.

18. Observations and experiments on the flight of birds; analysis of their flying mechanism, and its application to human flight; speed and economy of bird flight.

19. Aëronautic allied devices and novelties; kites, their design and use; parachutes, wind wagons, boomerangs, aëronautic models and toys, flying creatures other than birds.

20. Social and economic features of aërial locomotion; amusements and sports; history of aëronautic racing; history of aëronautic clubs and societies, their present membership, activity, and usefulness; census of aëronautic publications, industries, and various enterprises; governmental aëronautic establishments, their aims, equipment, and expenditures; value of aërial navigation to individual nations and to the world.

Papers may be presented covering only one or two of the various sub-divisions of the above twenty topics.

The presentation of papers to the Congress, on the above topics and allied ones, after approval by the Committee, will be made by abstract or by reading in full, as may seem advisable. The discussion of the papers will be necessarily limited in time, and it is hoped that the speakers will furnish a summary of their remarks to be preserved with the papers.

The publication of the papers and discus-

sions will be made by a special committee, who will decide how much of the proceedings shall be printed, and will edit the same. Decided preference will be given to those papers stating the results of actual experiment, or presenting rigorous mathematical proof, because facts and positive knowledge are deemed more instructive than projects or vague theories.

A reception and luncheon will be given to the members of the Congress immediately after the morning session on Monday, October 28.

Cards of admission to the Congress will be issued in advance by the Secretary of the Committee upon application to him, approval by the Committee, and the payment of a contribution of $3·00 to the publication fund. These cards will entitle the holder to attend the Congress and to receive all its subsequent publications.

All communications should be addressed to Ernest La Rue Jones, Secretary of Committees, 12 East 42nd Street, New York City.

Letter to the Editor.

THE METEOROLOGICAL CONDITIONS ABOVE ST. LOUIS.

To the Editor of the "Aëronautical Journal."

SIR,—In your April number you quote from the Aëronautical Map issued by the Aëro Club of St. Louis concerning the probable drift of the balloons which will start from that place next October in competition for the Gordon-Bennett Cup. Permit me first to point out that the length of a balloon voyage is to be reckoned in a straight line from the starting point to the place of landing, and therefore the distance accomplished by John Wise, who travelled from St. Louis to Henderson, New York, in 1859 was only about 970 miles, instead of the 1150 miles stated. The map also gives the tracks followed by some of the *ballons-sonde* which have been dispatched from St. Louis by Messrs. Clayton and Fergusson of this Observatory since 1904, but since less than half of the balloons returned to us figure on the chart, and since, moreover, no indication is given of the heights reached by these balloons, it seems worth while to furnish some details of the experiments, in view of their bearing on the probable course and speed of the racing balloons next autumn.

The balloons used in my experiments were the rubber balloons of Professor Dr. Assmann, which are well known in Europe, and were filled with hydrogen gas. Each carried a self-recording barometer and thermometer, constructed on Teisserenc de Bort's system, which a parachute, covering the upper portion of the balloon, brought safely to the ground after the balloon had burst on reaching the maximum height commensurate with its expansion. We sent up 56 of these balloons during the years 1904, 1905, and 1906, and, by remarkable good fortune, 53 balloons with their instruments were found and returned to this Observatory, on payment of a small reward to the finders. The records of barometric pressure and temperature were usually decipherable, and from the automatically-recorded times of the ascent of the balloon at St. Louis and its descent at a place, whose distance and direction from St. Louis are known, the average direction and velocity of its drift can be calculated.

Classifying according to altitude all the ascensions at different seasons of the year, I have obtained the figures for the movement of the air at different heights above St. Louis which are embodied in the accompanying table. No. 1 embraces the balloons whose maximum height was less than 18,000 ft.; No. 2 those in which the maximum height was between 16,000 and 33,000 feet; No. 3 those between 33,000 and 49,000 feet; and No. 4 those greater than 49,000 feet.

It will be seen that the velocity, and consequently the distance travelled, increases up to the third level, above which there is a slight decrease in velocity, and that the lowest balloons took the most southerly course (S. 79° E.), while the level 2 balloons went nearly due east (S. 87° E.). Naturally, there were great individual differences in velocity and direction. Thus, in level 1, which will hardly be exceeded by the manned balloons next October, one *ballon-sonde*, which reached a height of 7600 feet on Nov. 23, 1904, travelled 55 miles at an average velocity of 51 miles an hour, while the next day another balloon at a slightly greater altitude followed the same course but went 90 miles further. The minimum velocity was shown by a balloon on May 17, 1906, which, though it rose to a height of 14,700 feet, travelled only 15 miles north-east at an average speed of but 11 miles an hour. It appears probable, however, that the balloons which compete in the international cup race will travel at the rate of about 25 miles per hour towards a point slightly south of east, the distance, of course, depending upon the length of time that the balloons can keep afloat. In level 3, two of our *ballons-sonde* which reached heights of about seven miles in November, 1904, travelled at an average speed of 100 miles an hour, one 280 miles east, the other 255 miles south-south-east. As this is the average velocity in the upper and lower air strata, the velocity at the maximum altitude in both cases probably much exceeded 100 miles an hour, but such velocities are shown by the measurements of the drift of cirrus clouds at Blue Hill to be not unusual in winter over the United States.

Assuming that the mean temperature for October at St. Louis is 59° F., the temperature at two miles will be about 35° F. and at four miles about 15° F. Though far beyond the reach of the manned balloons, it may be interesting to

state that in January, 1905, at a height of about nine miles – 110° F. was recorded by one of our balloons, which is perhaps the lowest natural temperature ever observed, and that the following July – 75° F. was registered at a height of less than nine miles.

Level.	Number of Ascensions Utilized.	Mean Max. Altitude. (Feet.)	Mean Altitude. (Feet.)	Mean Distance Travelled. (Miles.)	Mean Velocity. (Miles per Hour).	Mean Direction from St. Louis.
4	9	52,500	26,000	117	47	S. 81° E.
3	16	40,500	20,000	155	56	S. 85° E.
2	13	23,500	12,000	101	38	S. 87° E.
1	8	11,500	6,000	42	25	S. 79° E.

A. LAWRENCE ROTCH,
Director.

Blue Hill Meteorological Observatory,
Hyde Park, Mass., U.S.A.
May 11, 1907.

NOTES.

Mr. Knabenshue's New Airship Gas Engine.—Mr. A. Roy Knabenshue's gas engine, which he has lately built for his new airship, is remarkable for combining what is the desideratum in airship engines, lightness and high horse-power. Its weight is said to be only 54 pounds, but it is also said to be capable of yielding 12 to 16 horse-power. The *New York Herald* has obtained the following facts concerning the engine :—"The engine is of a two-cycle pattern, and runs nicely at 100 revolutions a minute. The engine is valveless, and starts absolutely without fail with a half-turn. It will work with any carburettor. One of the features of the engine is the spark coil, which is also a freak. The coil, instead of containing, as do most coils, two windings of wire, a primary and a secondary, contains six windings, the last five of which are looped in series with a battery of condensers. The carburettor throttle and spark timer are also inventions of Mr. Knabenshue. The oil lubricator is different from most others in that it sends the lubricant into the machine with the gas mixture."

The Striking by Lightning of an Italian War Balloon.—History has not yet had to record very many instances of balloons being struck by lightning. On the occasion, however, of the opening by the King and Queen of the national target firing competition organised in connection with the Italian national *fête*, there was a melancholy example of the possibility. During the ceremony a small military balloon, with Captain Ulivelli in the car, was sent up in spite of the threatening weather, and soon reached an altitude of some 1000 feet. When the balloon was passing over a hill, simultaneously with a flash of lightning flames were seen to burst from the balloon, followed by a loud report. The car and the remnants of the balloon descended to the ground with great velocity. The hapless aëronaut was unconscious when he reached the ground, and died shortly after his removal to the hospital.

The Bombardment of War Balloons.—The *Morning Post* recently described the experiments in the bombardment of war balloons which have recently been in progress at Lydd Camp. The war balloon was sent up three miles from where the guns were in action. When it was at a height of about four hundred yards, the artillery opened fire upon it with shrapnel. The first shell missed the balloon, but the second caught it squarely and brought it down "a mass of wreckage."

The International Sporting Exhibition at Berlin.—In the Berlin International Sporting Exhibition, which opened on May 20, there was an Aëronautical Section illustrative of aëronautics of to-day in Germany. Amongst the exhibits were a model of the Zeppelin airship about 3 metres in length, a model of the Parseval airship about 1½ metres in length. The Lindenberg Observatory sent an interesting exhibit of aërology. An interesting item is the completely equipped car used for high ascents. Amongst the flying machines is the original kite of Jatho and the Lilienthal gliding machine.

The Observation of St. Elmo's Fire on a Balloon.—In *La Conquête de L'Air* of June 1 there is a note describing the observation of St. Elmo's fire on the rigging of a balloon. This phenomenon is frequently seen by sailors on the masts of ships, but it does not appear to have been often witnessed on a balloon by aëronauts. On the 20th of June at 5 o'clock in the evening the aëronauts, Messieurs M. N. Charles Levée, Alan Hawley, and Frank Corley, ascended in the balloon "La Mouche" from the grounds of the Aëro-Club of France. About midnight, just after the balloon had passed over Brussels, the aëronauts saw electric fires on the rigging of the balloon, accompanied with crackling sounds resembling the discharges of an electric battery. The height of the balloon at the time was 1110 metres, and the balloon had just experienced a storm of rain. The phenomenon lasted about a quarter of an hour. The aëronauts at first felt anxiety lest the St. Elmo's fire should ignite the

gas in the balloon, but it was soon recognised that the luminosity was not accompanied with sufficient heat to be a source of danger. During the luminous appearances ozone was liberated in sufficient quantities to be disagreeable.

Superposed Aëroplanes.—Owing to the revived interest in aëroplanes, some may perhaps think that the aëroplane is a new invention. Such may well read the few remarks on aërial flight which Mr. F. H. Wenham, a honorary member of the Aëronautical Society of Great Britain, recently wrote in the *English Mechanic*. He calls attention to the paper he read before the Aëronautical Society of Great Britain shortly after its foundation in 1866, one that Mr. Octave Chanute has well called classical. In this paper Mr. Wenham pointed out the impracticability of imitating the flight of a bird by means of a single pair of wings. "In order to obviate the impossibility of using a flat plane extended laterally in imitation of the wing of a bird, I superposed a series of webs above each other, which I named 'aëroplanes.' I made three machines on this principle, each of sufficient surface to carry a man. These I described at the time; but they had the fault of deficient equilibrium, and a liability to skid sideways. This I proposed to remedy by hinging the aëroplanes at mid-length, and tilting them up at an angle. A model so constructed descends steadily without side drift. Then comes the question of fore-and-aft stability. Instead of arranging the aëroplanes directly one above the other, as I had shown, if the lower ones were set progressively some distance back, the tendency to trip would be considerably lessened. As to the mode of propulsion, I doubt whether rotating screw-vanes are the most efficient, as they involve complicated gear, and are too gradual in their action on the air. For the smallest size of flying machine, I think a flapping wing action more suitable, having a slow rising and a very quick down stroke, for a sudden impact on the air. This can be effected by a simple mechanical action."

Screw Propellers v. Aëroplanes.—The *Times* Engineering Supplement recently called attention to two important papers presented to the French Académie des Sciences by Lieut. Tsoucales, of the Greek Navy, and by Lieut. Vlahavas, of the Greek Artillery. Both papers have been published in Les Comptes Rendus.

The first deals with the question of screw propellers and screws revolving on a fixed axis. In it the theory of screw propulsion is exhaustively treated. It contains formulæ showing the effective work done by the screw, the maximum force developed in the direction of its axis, and the amount of useful work from power output.

There is an instructive table in this paper, by means of which it can be ascertained which type of screw will give the maximum effect for a given power output.

The second paper is one that is likely to give rise to much discussion in Aëronautical circles. It is a comparative study of aëroplanes and bladed air propellers (Heliocoptère).

Having calculated the most favourable inclination for the surfaces of aëroplanes, they conclude that the aëroplane presents no advantages as compared with the screw. "With only 6 per cent. of the work put into the aëroplane the screw will give the same amount of sustentation and the same effect of translation. Moreover, in the case of the screw there is no need of planes of support, which entail useless weight and interfere with the stability. Finally the authors, making use in all cases of analysis, prove that the theory relied upon hitherto by experimenters with aëroplanes must be rejected, since in effect it conducts to perpetual motion. They thus claim to demolish a theory which until now has been accepted as axiomatic, and having shown this to be so there remains no advantage whatever in the use of the aëroplane."

Mammoth Balloons.—A balloon of very large dimensions has recently been made by Mr. Gaudron for Mr. W. Tanner. It has a capacity of 108,000 cubic feet, a diameter of 56 feet, and a superficial area of 33,330 square feet. The lifting power of the balloon will be 4,320 lbs. It is claimed that this is the largest balloon that has ever been made in this country. It was, however, run very close by the balloon of some 100,000 cubic feet capacity made some years ago for Mr. Eric Stuart Bruce by the late Mr. Dale.

The Travel Exhibition.—At the Travel Exhibition held in May last at the Horticultural Hall, Westminster, considerable attention was paid to aëronautics. A room was, in fact, set apart for a loan collection of models, photographs, diagrams, charts, and old prints. Conspicuous amongst the loan collection was the exhibit of photographs, &c., contributed by the Aëronautical Society of Great Britain. This was the same collection which won a silver medal at the Milan Exhibition in 1906. In the same room Mr. C. S. Rolls exhibited his valuable collection of prints which were exhibited a few years ago at one of the meetings of the Aëronautical Society of Great Britain. In another part of the Exhibition Mr. Balston showed kites and aëroplanes, Mr. Roe model aëroplanes, and Mr. W. Cochrane a corrugated flying machine. In the gardens of the Exhibition there was a captive balloon under the management of Mr. P. Spencer, which made frequent ascents.

Foreign Aëronautical Publications.

(In this list a selection of some of the more notable articles is only given.)

L'AÉRONAUTE (Paris).

April, 1907.—La Thermométrie du ballon (W. de Fonvielle).—Discussion et examen

critique des récentes expériences d'aéroplanes (Chauvière).—La Conquête de l'air par l'hélice (Vicomte de Ponton d'Amécourt).—Analyse Sommaire d'un article de Graham Bell (Trochery).

May.—Revendication aéronautique (Comte de Carelli).—Aéronef Malécot (C. Chavoutier).—La Conquête de l'air par l'hélice (Suite).

June.—Résistance opposée par l'air aux corps en mouvement.—Communication sur les expériences de photographie à grande base (Arthur Batut).—La Conquête de l'air par l'hélice (Suite).

L'AÉROPHILE (Paris).

April.—Portraits de Femmes Aéronautes: Mme. Marie-Anne Lafaurie.—Les aéromoteurs de J. Ambroise Farcot (L. Lagrange).—Machines Volantes d'aujourd'hui et de demain.

May.—Portraits d'Aéronautes Contemporains: Vicomte Ch. de Vidal de Lirac (A. de Masfrand).—Aëroplanes aujourd'hui et demain.

June.—Portraits d'Aéronautes Contemporains: Ernest Zens. (A. de Masfrand).—Sur la Stabilité des Aéroplanes (P. Vole).—L'Aéroplane Edmond Seux.

ILLUSTRIERTE AERONAUTISCHE MITTEILUNGEN (Strassburg).

April.—Wilhelm V. Bezold (Arthur Berson). Die Form des Tragkörpers von Luftschiffen (P. Denninghoff und H. Elias).—Die Pläne Wellmanns für 1907.—Aus der flugtechnischen Praxis (R. Schelies).—Der Neue Motorgleitflieger von Etrich-Wels (Dr. R. Nimführ).—Über Vortreib-Schrauben (F. Ferber.)

May.—Die Versuche mit dem Lebaudy-Luftschiffe im Jahre, 1905 (Voyer).—Die Drachenflieger (G. Wellner).—Warum der Antoinette-Motor der leichteste und bisher der einzig branchbare Motor für Fleigmaschinen ist (Captain Ferber).

June.—Die Meteorologischen Verhältnisse über St. Louis (A. L. Rotch).—Kgl. Aëronautisches Observatorium Lindenberg.—Lustige und traurige Episoden aus den ersten Jahren der Ballon-Aera (1785) (Max Leher).

WIENER LUFTSCHIFFER-ZEITUNG (Vienna).

April.—Meerfahrten einer Dame—Ein Grosses Sterben (W. De Fonvielle).—Hauptmann Georg Von Schrimpf.

May.—Sensationelle Fahrt—Georg Von Tschudi.—Die Motorluftschiff-Studiengesellschaft Zu Berlin.—Photographischer Wettbewerb Balsan.

BOLLETINO DELLA SOCIETÀ AERONAUTICA ITALIANA (Rome).

April.—Dinamica degli aerostati dirigibili (G. A. Crocco).—Intorno alla forma delle superfici sostentatrici.—Sulle traiettorie degli aerostati naviganti in aere cicloniche (P. Burgatti).—I venti in Italia (Dr. F. Eredia).

Applications for Patents.

(*Made in April, May, and June.*)

The following list of Applications for Patents connected with Aëronautics has been specially compiled for the AËRONAUTICAL JOURNAL by Messrs. BROMHEAD & Co., Patent Agents, 33, Cannon Street, London, E.C.

APRIL.

J. D. ROOTS. **Improved Aerial Machine.**

7473. W. J. STILL. **Improvements in or connected with propelling, raising, depressing and steering apparatus for aerial machines and for other purposes.**

7887. April 10th. F. W. H. HUTCHINSON. **Improvements in and relating to Flying Machines.**

17894. F. W. THOMAS. **Improvements in aeroplanes and flying machines applicable also to man-lifting kites.**

17967. C. CRASTEN. **Improvements in helicopters or screw winged flying machines.**

7974. April 17th. A. E. GAUDRON. **New mechanical ballast discharger for balloons and the like.**

8116. R. SHAPLAND. **Improvements in aeroplanes, kites and similar apparatus for use in aerial flight.**

8435. J. SAWARD. **Air ship.**

8716. April 24th. E. P. FROST AND F. W. HUTCHINSON. **Improvements in artificial feathers or wings for flying machines.**

8818. C. G. UNDERWOOD. **Apparatus for balancing aeroplanes and the like.**

8966. W. A. MCCURD. **Improvements in flying machines.**

9101. M. J. SCHULTE. **Improvements in or relating to flying machines.**

9119. W. V. REDEN. **Improvements in flying machines.**

9114. C. HEIN. **New or improved appliance for showroom windows.**

MAY.

9299. FR. BARNES AND D. GRAHAM. **Improvements in and relating to aerial vessels.**

9413. F. W. LANCASTER. **Improvements in aerodromes applicable to balloons and submarine vessels.**

9433. S. T. WILLIAMS. **Improvements in apparatus for aerial photography.**

9445. J. E. CAPPER AND G. BREWER. **Apparatus for obtaining photographs from balloons and kites.**

9469. J. H. LEE. **Improvements in and connected with the propulsion of aeroplanes over water.**

9594. J. L. GARSED. **Improvements in the method and means employed for propelling and steering aerial machines.**

9691. B. F. S. BADEN-POWELL. **Aerial machine.**

9847. J. B. PASSAT. Improvements in apparatus for aerial navigation.

9940. P. A. KENNA. Improvements in and relating to propellers for aerial navigation.

10,004. E. BODE. Aeroplane.

10,361. A. H. EDWARDS. New or improved construction of apparatus or appliance for use in marine navigation.

10,603. May 15th. L. KINGSLEY. Parachute gun and parachute.

10,961. J. SCHULKE. improvements in flying apparatus.

11,106. May 23rd. R. M. JONES. Device to improve aeroplanes and airships of any description in reference to their stability.

111,317. A. HOFFMAN AND F. FROHLICH. Improved flying machine.

11,188. M. BUCH. Improvements in flying machines.

11,418. H. B. WEBB. Improvements in aeroplanes or flying machines and the like models thereof.

11,863. May 29th. G. CASTAGNERIS. Suspension of the balloon car to the inner walls of the gas bag.

JUNE.

12,156. June 5th. T. M. HEWITSON. Improvements in air ships.

12,509 L. F. GOWANS. Improved air ship or air navigator.

12,650. E. JONES. Improvements in or connected with flying machines.

12,718. W. BROOKS. Improvements in and relating to captive balloons.

12,848. June 12th. A. PENGEOT, T. HUBER, AND H. DE LOSTALOT. Improvemnnts in or relating to apparatus for aerial navigation.

13,905. E. TEZKA. Improvements in or relating to flying machines.

14,042. H. RUTHENBERG. Improvements in wings for aerial apparatus.

14,205. F. E. JACKSON. Improvements in kite parachutes and the like.

14,216. J. GARSED. Improvements in or connected with aerostats or aerial machines.

14,334. J. MACINAYTE. Flying machines.

NOTICE.

"Researches on the Forms and Stability of Aëroplanes," by W. R. Turnbull. Members of the Aëronautical Society of Great Britain who may wish for copies of this pamphlet can obtain the same by applying to

W. R. TURNBULL, M.A.,
Laboratory,
Rothesay, N.B., Canada.